p172 Q7

$F_g=GMm/r^2$
$= 6.67 \times 10^{-11}\ Nm^2/kg^2\ (1.99 \times 10^{30}kg) \times (1.90 \times 10^{27}\ kg)/\ (7.781 \times 10^{11}m)^2$
= 6.67E (Exp, EE) -11 calculator
$4.17 \times 10^{23}N$

Q8 $F_g=GMm/r^2$ =
$= 6.67 \times 10^{-11}\ Nm^2/kg^2\ (70kg) \times (50kg)/\ (20m)^2$
$= 5.84 \times 10^{-10}N$

Q 12

P106 Q4,6,8,10,11,16,17,20
p107 Q22,23,26,28,29
Force -
Newton's 3 laws
$F_{net}=ma=\Sigma F$ - free body diagram of forces
weight = $F_g=mg$ near Earth g=9.80N/kg

$F_g=GMm/r^2$ if you get far from Earth

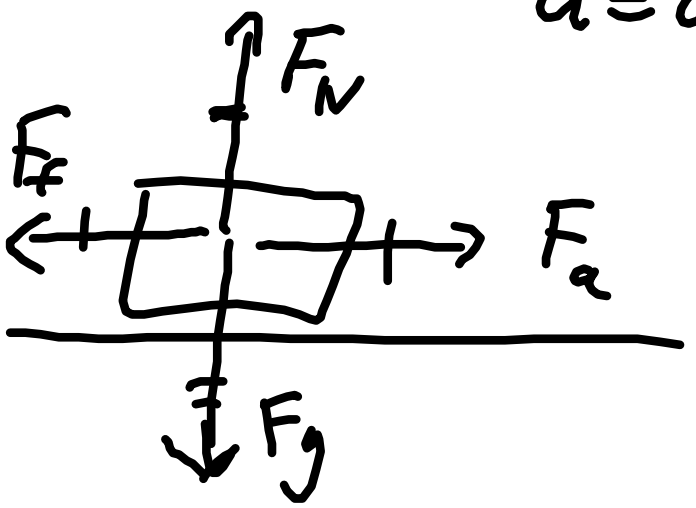
$F_f=\mu F_N$

μ is the coefficient of friction - depends on the surfaces

tension is the force at each end of a string or cable

Quiz

1 a) $a=0$



b) Weight = Force of gravity = F_g

$F_g = mg = 0.35\,kg \times 9.8\,N/kg$

$= \boxed{3.4\,N}$

$= 4.4\,N$

c) if $a = 0$ $\quad F_a = F_f = 1.5\,N$

$$\mu = \frac{F_f}{F_N} = \frac{1.5\,N}{3.4 \text{ or } 4.4\,N} = \begin{matrix} 0.34 \\ 0.44 \end{matrix}$$

d) $$a = \frac{F_{net}}{m} = \frac{F_a - F_f}{m}$$

$$a = \frac{3.0\,N - 1.5\,N}{0.45 \text{ or } 0.35} = \begin{matrix} 3.3\,m/s^2 \\ 4.4\,m/s^2 \end{matrix}$$

Q2 a)

↑ $a = 2.0\,m/s^2$

$a = 2.0 \text{ m/s}^2$

$F_{net} = ma = \Sigma F$

$ma = F_N - F_g$

$F_N = ma + mg = 45\text{kg}(2 + 9.8)$
60kg

$= 5.3 \times 10^2 \text{ N}$
$\sim 7.1 \times 10^2 \text{ N}$

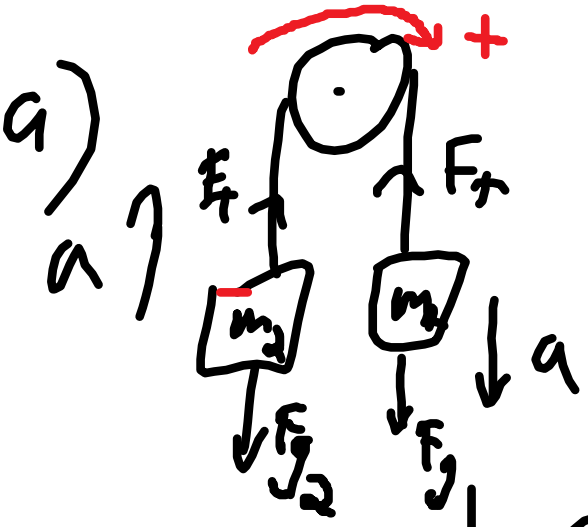
b) $v = 2 \text{ m/s}$ so $a = 0$ *

$F_N = \cancel{ma} + F_g$

$F_N = mg =$ 440 N / 590 N

$F_N = mg =$ **59 N**

Q3 a)



$$a = \frac{F_{net}}{m}$$

$$a = \frac{F_{g_1} - F_{g_2}}{m_1 + m_2}$$

$$(m_1 + m_2)a = m_1 g - m_2 g$$

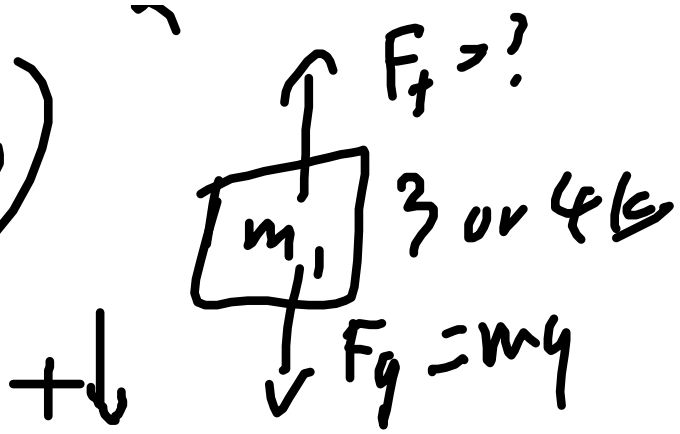
$$m_2 a + m_2 g = m_1 g - m_1 a$$

$$m_2 = \frac{m_1 (g - a)}{g + a} \qquad \frac{3(9.8-4)}{9.8+4}$$

$$m_2 \simeq 1.7 \text{ kg or } 2.1 \text{ kg}$$

b) $F_t = ?$

b)



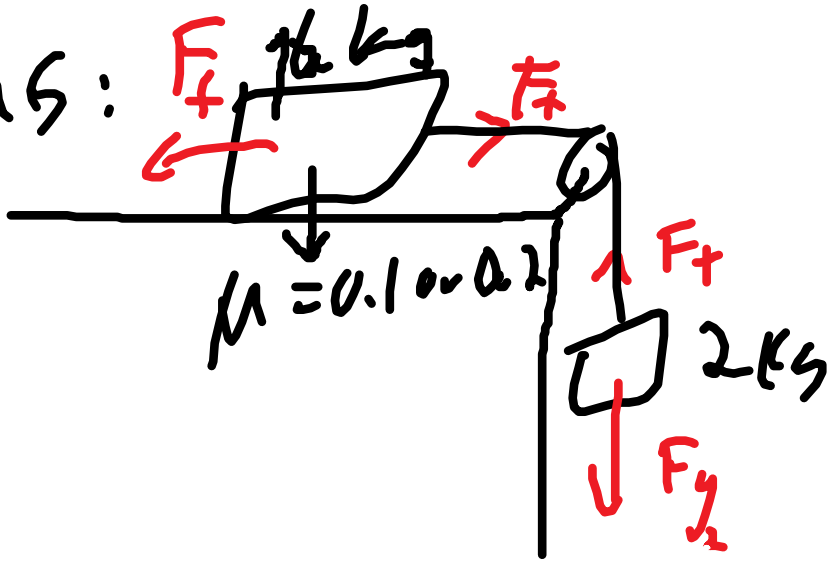
$$m_1 a = F_g - F_t$$

$$F_t = mg - ma = m(g - a)$$

$$F_t = (3 \text{ or } 4)(9.8 - 4)$$

$$= 23 \text{ N or } 27 \text{ N}$$

bonus:



$$F_{net} = \Sigma F = F_{g_2} - F_f = m_2 g - \mu m_1 g$$

$$= (m) a \qquad a = \frac{2(9.8) - \frac{0.1}{0.2} \times 6 \times (9.8)}{2 + 6}$$

↑ total

$$a = 1.0 \text{ m/s}^2 \text{ or } 1.7 \text{ m/s}^2$$